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ABSTRACT

A systematic research program will study the cumulative effects of selected instructional variables on learning a spatial visualization task. The goal of the research is to identify instructional variables that will improve the performance of female students on the Aircraft Instrument Comprehension (AIC) test. The AIC program is intended to teach Air Force cadets to read aircraft instruments and identify pictures of aircraft in the positions indicated on the instruments. Study 1 will determine the individual and combined effects of two different perspectives (subjective and objective) and two different sequences (attitude first or heading first) for presenting cues in the AIC program. Study 2 will examine the effects of pre-instruction on performance of a spatial visualization task. Pre-instruction will be used to familiarize 150 undergraduate college students with the features (front, back, right/left sides) and rotations (pitch, bank, and heading) of an aircraft. The third study will determine the effectiveness of imagery instruction for learning a spatial visualization task. The differential effectiveness of the imagery strategy for subjects with high and low visual ability will be determined using 120 undergraduate education majors. Six references are listed. (LMM)

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THE EFFECTS OF SELECTED VARIABLES ON LEARNING A SPATIAL VISUALIZATION TASK: A REPORT OF RESEARCH IN PROGRESS

This paper describes a systematic research program that has been designed to study the cumulative effects of selected instructional variables on learning a spatial visualization task. The three studies described in the paper are "in progress", they have not been completed.

Background:

Higgins developed a self-instructional programmed text to teach Air Force cadets to read aircraft instruments and identify pictures of aircraft in the positions indicated on the instruments. A sample item from the criterion test used to assess the effectiveness of the instructional program is presented in figure 1. The instructional program included directions for reading the instruments and practice/feedback on identifying aircraft in the positions indicated on the instruments. The program was highly effective when used with the all male ROTC cadets for whom it was designed. Cadets who participated in the field test on the program had mean percentage scores of 53% correct on a nine-item pretest and 87% correct on a 36 item posttest (Higgins, 1975).

In 1983 Higgins adapted the Aircraft Instrument Comprehension program to a slide-tape presentation. The slide-tape program included the same direct instruction and practice used in the programmed text. The instruction in the slide-tape program is presented orally at a fixed pace with no opportunity to review information once it is presented. The slide-tape version of the AIC program has been presented to several groups of students, mostly females, enrolled in teacher education programs at Arizona State University. Mean percentage scores for these groups on a 10 item pretest have ranged from 33% to 34% correct. Mean percentage scores for the groups on a 20 item posttest range from 63% to 68%.

The studies that follow are designed to identify instructional variables that will improve the performance of female students on the AIC test.

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Study 1
Joellyn Pollock

Problem Statement:

This study is designed to determine the individual and combined effects of two different perspectives (subjective and objective) and two different sequences (attitude first or heading first) for presenting cues in the Aircraft Instrument Comprehension program. It is hypothesized that presenting cues that start from the learner's subjective point of view (zero degree camera angle) and progress to an objective point of view (45 degree to 180 degree camera angle) will be the more effective procedure for naive learners learning to read aircraft instruments.

Background:

Gibson's (1947) studies of the use of line drawings with distortions of distinctive features to teach aircraft identification and his use of zero angle (subjective point of view) to teach gunnery skills to aviation cadets is an early effort to understand how audiovisual techniques can be used to present effective instructional cues. Roshal (1949) demonstrated the superiority of zero degree camera angle (subjective view) over a 180 degree camera angle (extreme objective point of view) for presenting cues needed to perform a knot tying task. This study extends the previous research to a complex spatial visualization task.

Methods:

Subjects:

Female elementary education majors enrolled in IME 411 in the Department of Educational Technology will serve as subjects.

Materials:

Four versions of Higgins' AIC sound-slide program will be produced for this study. In the first program, the learner will be oriented to read the instruments from "inside" the aircraft pictured (subjective orientation). In this program, the attitude indicator will be presented first because it can be read from a subjective orientation without having to mentally rotate the aircraft pictured; then the heading indicator will be presented. The second program will combine the subjective oriented cues with a heading then attitude sequence. The third program will combine objective oriented cues (cues oriented from outside the aircraft) with an attitude then heading sequence. Storyboard samples of the four programs are presented in Figure 2. The fourth program presents objective cues with a heading then attitude sequence.

Procedures:

A posttest-only control group experimental design will be used. Subjects will be randomly assigned to one of the four treatment groups. Each group will meet separately to view their version of the instructional program. The criterion test will be administered at the conclusion of the instructional program. Subjects' posttest scores on the AIC test will be analyzed using analysis of variance (ANOVA) procedures.

Study 2
Kimberly Koenigs

Problem Statement:

This study is designed to examine the effects of pre-instruction on performance of a spatial visualization task. Pre-instruction will be used to familiarize participants with the features (front, back, right/left sides) and rotations (pitch, bank, and heading) of an aircraft.

Background:

Two studies have been identified which directly relate to the hypothesis that use of a pre-instructional program will significantly raise the scores of naive learners on the AIC criterion test. Ives and Rakow (1983) found that when children use pictures to solve rotation tasks and are required to rotate objects with inherent feature descriptions, their performance is significantly lower than when objects with inherent features are used or when language, which supplies a feature description, is used. Seddon, Eniaiyeju, and Jusoh (1984) found that remedial instruction which made use of concrete models, shaded diagrams and simple media animation techniques were effective in teaching Nigerian students (predominantly teenage males) to identify chemical molecules in various positions of rotation.

Methods:

Subjects:

A sample group of 150 undergraduate college students will participate in this study.

Materials:

A series of slides will be prepared to present, in split screen format, instruction, practice, and feedback relating to perspective aircraft features and rotations. An audiotape will supplement the slides by providing oral instructions, prompts, and feedback related to the illustrations of aircraft presented.

Procedure:

A posttest-only control group experimental design will be used. The experimental group will be presented pre-instruction, the AIC program, the AIC posttest, and an attitude questionnaire. The control group will be presented the AIC program, the AIC posttest, and the attitude questionnaire.

The AIC posttest scores will be statistically analyzed using analysis of variance (ANOVA) procedures. Response to the attitude questionnaire will be analyzed to determine if students found the pre-instruction to be helpful in performing the AIC task.

Study 3
Randall R. Molina

Problem Statement:

This study is designed to determine the effectiveness of imagery instruction on learning a spatial visualization task. The effects of visualization demonstration and visualization practice on learner posttest performance will be examined. The differential effectiveness of the imagery strategy for subjects with high and low visual ability will be determined.

Background:

Seddon, Eniaiyeju, and Jusoh (1984) investigated the effects of visualization instruction on learning to identify illustrations of chemical molecules in various positions of rotations. Subjects who received instruction in visualizing the effects of rotation performed significantly better on a Rotations Test than a comparison group. They also determined that a 10 degree stepsize using dissolves between slide changes was significantly more effective than larger stepsizes and abrupt slide changes.

Methods:

Subjects:

The sample will consist of 120 undergraduate education majors enrolled in an Instructional Media Education course randomly assigned to one of four treatment groups.

Materials:

The materials will consist of a series of slides which (a) demonstrates how to use a four-step procedure to construct a mental image of an aircraft in the position indicated on aircraft instruments, and (b) provides practice using the four-step visualization procedure. The visualization instruction will be embedded in the most effective version of the AIC program produced in the previous two studies. Treatment combinations of visualization demonstration and practice will be prepared. Two levels of visualization demonstration (presence and absence) and two levels of practice (presence and absence) will be completely crossed.

Procedures:

The Cards Rotations Test will be administered prior to initiating the experiment. Subjects will view the AIC program then complete a twenty-item criterion posttest and a brief questionnaire. A Posttest-Only 2 X 2 factorial experimental design will be used. Figure 4 illustrates the experimental design. A univariate analysis of variance will be performed to determine the individual and combined effects of demonstration and practice on posttest scores. Data from the spatial visualization ability test and the post-instruction questionnaire will be correlated with posttest scores. A significant difference is expected for confirmation of the hypothesis that imagery instruction which includes both visualization demonstration and visualization practice can improve learner posttest performance on a spatial visualization task.

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